TRAFFIC SPEED REPORT

NO. 70

TRUCK WEIGHT-SPEED STUDY

SEPTEMBER 1960

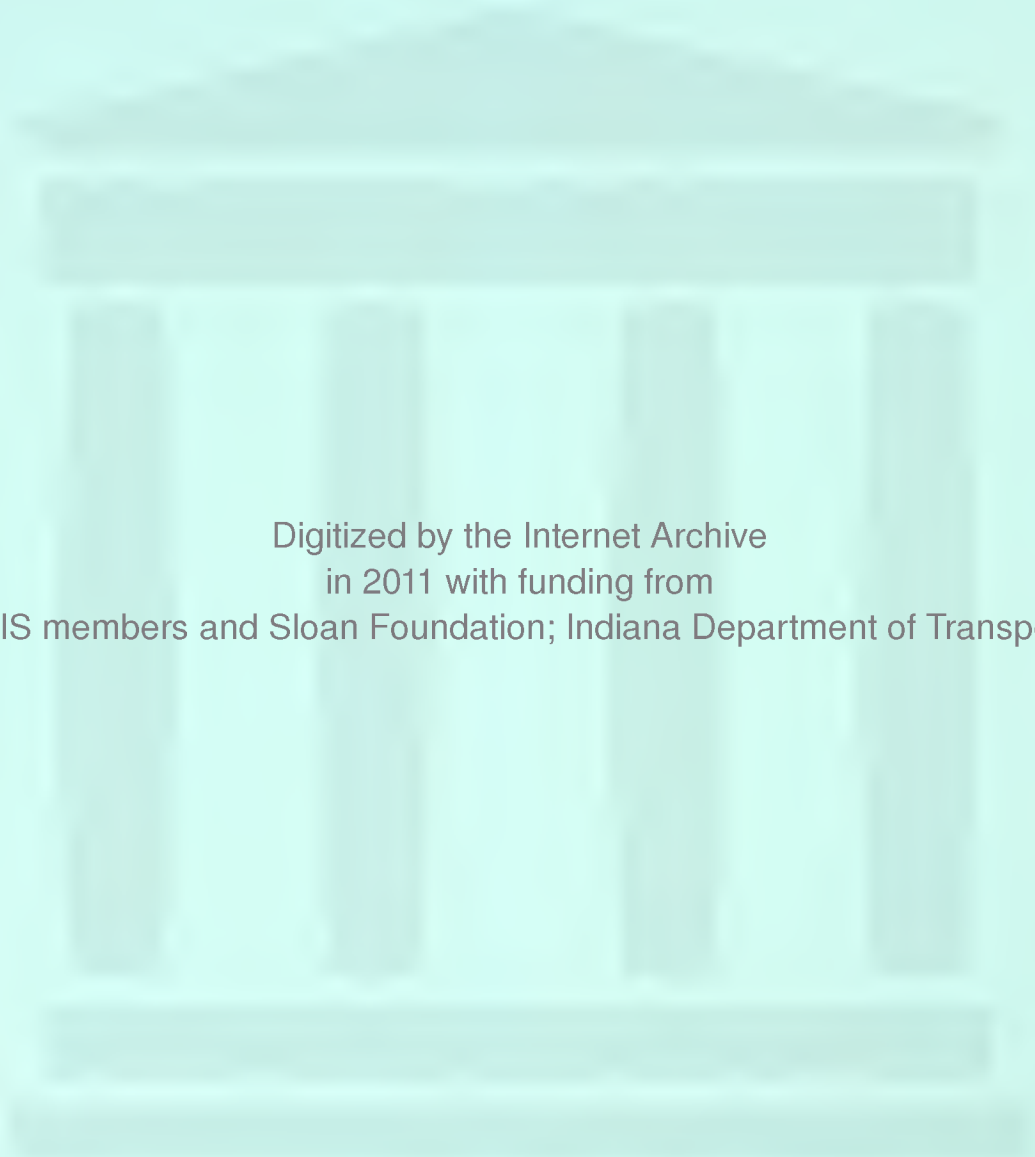
NO. 16

Joint Highway Research Project

PURDUE UNIVERSITY
LAFAYETTE INDIANA

by

D. F. PETTY



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Progress Report

TRAFFIC SPEED REPORT NO. 70
TRUCK WEIGHT-SPEED STUDY

TO: K. B. Woods, Director
Joint Highway Research Project

September 21, 1960

FROM: H. L. Michael, Assistant Director
Joint Highway Research Project

File: 8-3-4
Project: C-36-10D

Attached is Traffic Speed Report No. 70. This is a report of the 1960 Truck Weight-Speed Study. The Project has cooperated with the Highway Planning Survey Unit of the State Highway Department for a number of years in the conduct of this study. Project personnel obtain the speeds while State Highway Department personnel obtain the weights of trucks at selected stations during the month of August.

The Speed Study in 1960 was performed by Mr. Donald F. Petty, Research Assistant on our staff assisted by Mr. Forrest Miller, Graduate Assistant on our staff. Results of this year's study indicate a continuing increase in the speed of all classes of trucks and in the weight of single-unit trucks. A significant increase in the number of trucks exceeding the legal speed limit was also noted. This followed by one year the decrease which occurred last year following the increase in the legal speed limit for trucks on the highways in Indiana.

This report, as usual, will be distributed to the State Highway Department, Bureau of Public Roads, and the State Police. The report is submitted for the record and for release.

Respectfully submitted,

Harold L. Michael

Harold L. Michael, Secretary

HLM:kmc

Attachment

cc: F. L. Ashbaucher
J. R. Cooper
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Progress Report

Traffic Speed Report No. 70
Truck Weight-Speed Study

by

Donald F. Petty
Research Assistant

Joint Highway Research Project
Project: C-36-10D
File: 8-3-4

Performed in Cooperation
with
The State Highway Planning Survey
State Highway Department of Indiana

August 4, 10, 11, 12, 17, 22, 23, 24, 26, 1960

Purdue University
Lafayette, Indiana

September 21, 1960

TRAFFIC SPEED REPORT NO. 70
TRUCK WEIGHT-SPEED STUDY

INTRODUCTION

The Joint Highway Research Project of Purdue University cooperated with the Highway Planning Survey Unit of the State Highway Department of Indiana, in performing the annual truck weight-speed study during August 1960. This was the sixteenth year this particular study has been conducted.

Prior to 1944, these studies were limited to determining the truck weight distribution pattern at twenty stations. The first of the annual truck weight-speed studies was made in 1944, and they have been continued until the present except for 1945. When the truck weight-speed studies were initiated, speeds were taken at only four of the twenty weight stations. The number of stations increased until 1951, when twelve stations were used. The number of truck weight stations has been limited to nine for the last three years.

The speed observations for this study were made with a Streeter-Amet pnumatic speed meter. The tubes were anchored across the road eleven feet apart. The speeds are measured by the front wheels of a vehicle actuating a timer "on" at a first tube and "off" at a second tube. Since the tubes are always eleven feet apart, the meter is calibrated in miles-per-hour instead of seconds, and therefore speeds are taken directly from the meter. The observers concealed themselves as much as conditions permitted. However, the tubes across the road could not be completely concealed, and they probably affected the speed of a few vehicles whose drivers were wary of speed enforcement. The number

of drivers, however, slowing or braking because of the tube appeared to be lower than in 1959.

The meter and car speedometer were calibrated before the project started. The car was then used at least twice each day to check the speed meter accuracy and any necessary adjustments were made to the meter.

The speed and weight data were collected by the writer and Mr. Forrest Miller. Dr. Robert Crist substituted for Mr. Miller at two of the stations.

Observation Procedure

The stations used for the truck weight-speed study, which are geographically shown on the included map of Indiana (Figure 1), were located and operated as shown below:

Date	Station	Highway	Location	No. Of Lanes
Aug. 4	45B	S.R. 67	1.00 miles S. W. of Muncie	2
Aug. 10	5	U.S. 30	1.30 miles E. of E. city limits of Bourbon	2
Aug. 11	4	U.S. 31	1000' S. of Jct. of U.S. 6	4
Aug. 12	2	U.S. 20	1500' W. of Jct. of S.R. 2	4
Aug. 17	14	U.S. 41	0.50 miles S. of N. Jct. of S.R. 2	4
Aug. 22	42	U.S. 52	600' S.E. of N. Jct. of S.R. 28	4
Aug. 23	58B	U.S. 31	1000' S. of Jct. of Co. Rd. to Southport	4
Aug. 24	75	U.S. 41	0.25 miles S. of Jct. of U.S. 41, business route	4
Aug. 26	81	U.S. 150	0.50 miles E. of W. Jct. of S.R. 56	2

The speed stations were selected on the basis of topography and distance from the weight station. A level tangent section of road was selected, if possible, from one to two miles from the weight station. In all cases the distance from the weight station was great enough to permit the trucks to regain their normal cruising speed.

The weighing crew, operating portable loadometer scales, stopped and weighed all trucks in one direction at a given weight station for a four hour period, and in the opposite direction for another four hour period. This eight hour period was from 8:00 AM to 4:00 PM C.D.T. at each station.

The speed stations were operated for the same time periods as the weight stations. The speeds were recorded to the nearest mile per hour.

To aid in the correlation of the speed and the weight data, the color, owner and type of vehicle were also recorded at each station. Because some trucks turned off between the speed and weight stations, data was only taken at one station and therefore was not usable for this speed study. Traffic conditions also caused a few trucks to pass the speed station without data being taken.

Reporting Procedure

For the purpose of this report, all trucks were divided into two groups: single-unit trucks and multiple-unit trucks (mostly semi-trailers). The former group was further divided into two groups for some of the analysis: trucks under 5000 pounds gross weight and trucks over 5000 pounds gross weight. This was done to compare the speeds of

these trucks with the legal speed limits for each group. The present speed limits are 50 miles per hour and 55 miles per hour for trucks with a gross weight of over 5000 pounds on two lane and four lane divided highways respectively. The speed limit for trucks under 5000 pounds gross weight was 65 miles per hour on all highways selected for this study.

Table I provides the speed and weight data observed at each station for both classifications of single-unit trucks. Table II is similar to Table I except that it provides the data for multiple-unit trucks. The number and percentage of vehicles exceeding the legal and "enforcement" speed limits, by station is shown in Table III. All station speed accumulation curves for single-unit trucks and for multiple-unit trucks are shown in Figure 2. Similar curves are shown for two-lane and four-lane highways in Figures 3 and 4 respectively. A speed weight comparison is presented in graphical form in Figures 5 and 6, for single-unit trucks and multiple-unit trucks respectively.

Summary of Results

From tables I and II the following observations are made:

Single-unit trucks with a gross weight of less than 5000 pounds:

Number of vehicles observed	47
Average speed	53.3
Average weight	4100

Single-unit trucks with a gross weight of over 5000 pounds:

Number of vehicles observed	377
Average speed	46.6
Average weight	13000

All Single-unit trucks:

Number of vehicles observed	424
Average speed	49.1
Average weight	12000

Multiple-units (Semi-trailers)

Number of vehicles observed	644
Average speed	50.3
Average weight	39300

Data for 1949 through 1960 are shown on a comparison basis in Table IV.

The data obtained during the 1960 study revealed that for the single-unit trucks weighing less than 5000 pounds, the average speed was 6.1 miles per hour higher and the average weight 280 pounds lighter than for similar trucks in the 1959 study.

For single-unit trucks weighing over 5000 pounds, the average speed was 3.7 miles per hour higher and the average weight 1900 pounds heavier than in 1959 for the same class of truck. Multiple-unit trucks indicated an average speed 1.7 miles per hour higher and an average weight 1000 pounds lower than was found for similar trucks in 1959.

It was observed that 8.5 per cent of the trucks weighing under 5000 pounds gross weight were exceeding the legal speed limit of 65 miles per hour and that 4.3 per cent were exceeding 70 miles per hour. For single-unit trucks weighing over 5000 pounds, 35.8 per cent were exceeding the legal speed limit of 50 miles per hour on two-lane roads and 55 miles per hour on four-lane roads which had a median strip twenty feet wide or more. In this particular class of trucks, 17.0 per cent were traveling more than 5 miles per hour over the speed limit. For multiple-unit

trucks, 30.6 per cent were exceeding the legal speed limit of 50 miles per hour on two-lane roads and 55 miles per hour on qualifying four-lane roads. Only 7.8 per cent of these trucks, however, were traveling more than 5 miles per hour above the legal speed limit.

The results of the speed limit violations part of this study are shown in Table III. As can be seen from the following table, there has been an increase in speed limit violations since 1959:

	Per cent Exceeding Legal Speed by 5 MPH		Per cent Exceeding Legal Speed by 5 MPH	
	1959	1960	1959	1960
Single-unit trucks less than 5000 pounds	2.3	8.5	0.0	4.3
Single-unit trucks over 5000 pounds	20.7	35.8	6.9	17.0
Multiple-unit trucks	21.7	30.6	5.8	7.8

HOUR						
N 75 , 1960		STATION 81 AUG. 26, 1960		SUMMARY		
WEI	NO. OF TRUCKS	AVG. SPEED	NO. OF TRUCKS	AVG. SPEED	NO. OF TRUCKS	WEIGHT (KIPS)
C	3			53.9	12	0——4
4	6	51.3	17	53.1	35	4——5
TOT		17		47		TOT. TRUCKS
AVG	0	4,300		4,100		AVG. WT. (LBS)
AVG	0	51.3		53.3		AVG. SPEED
5	18	51.3	9	50.0	84	5——8
8	21	46.7	16	51.7	119	8——12
12	5	52.2	12	50.9	82	12——16
16	3	50.2	10	47.4	40	16——20
20	1	46.2	4	49.6	26	20——24
24		48.0	4	48.0	7	24——28
28		51.0	1	48.0	2	28——32
32	3	54.0	1	50.3	8	32——36
36	2	46.0	1	44.3	7	36——40
40				52.5	2	40——44
TOT		58		377		TOT. TRUCKS
AVG	00	14,600		13,000		AVG. WT. (LBS)
AVG	2	49.5		48.6		AVG. SPEED

TABLE I SINGLE UNIT TRUCK SPEEDS IN MILES PER HOUR

WEIGHT (KIPS)	STATION 45B AUG. 4, 1960		STATION 5 AUG. 10, 1960		STATION 4 AUG. 11, 1960		STATION 2 AUG. 12, 1960		STATION 14 AUG. 17, 1960		STATION 42 AUG. 22, 1960		STATION 58B AUG. 23, 1960		STATION 75 AUG. 24, 1960		STATION 81 AUG. 26, 1960		SUMMARY		WEIGHT (KIPS)
	AVG. SPEED	NO. OF TRUCKS	AVG. SPEED	NO. OF TRUCKS	AVG. SPEED	NO. OF TRUCKS	AVG. SPEED	NO. OF TRUCKS	AVG. SPEED	NO. OF TRUCKS	AVG. SPEED	NO. OF TRUCKS	AVG. SPEED	NO OF TRUCKS	AVG. SPEED	NO. OF TRUCKS	AVG. SPEED	NO. OF TRUCKS	AVG. SPEED	NO. OF TRUCKS	
0——4	52.0	2	65.0	1	55.6	3	50.7	3							46.0	3			53.9	12	0——4
4——5	50.0	3	56.0	1	48.8	5			56.7	3					56.0	6	51.3	17	53.1	35	4——5
TOT. TRUCKS	5		2		8		3		3						9		17		47		TOT. TRUCKS
AVG. WT. (LBS)	4,100		4,200		4,100		3,500		4,300						4,200		4,300		4,100		AVG. WT. (LBS)
AVG. SPEED	51.0		60.5		52.2		50.7		56.7						51.0		51.3		53.3		AVG. SPEED
5——8	40.0	2	56.9	10	54.4	18	50.8	4	48.0	4	46.2	5	53.6	14	48.8	18	51.3	9	50.0	84	5——8
8——12	52.0	2	54.7	7	53.0	15	52.4	12	55.7	3	51.5	13	52.7	30	46.5	21	46.7	16	51.7	119	8——12
12——16	52.0	3	52.1	10	50.5	13	52.8	11	49.9	10	53.0	9	50.5	9	45.0	5	52.2	12	50.9	82	12——16
16——20	40.0	2	53.0	1	52.1	9	53.6	7	42.0	1			46.4	7	42.0	3	50.2	10	47.4	40	16——20
20——24			49.0	4	57.3	3	47.0	3	51.0	1	51.3	3	49.6	7	45.0	1	46.2	4	49.6	26	20——24
24——28							45.0	1			48.0	1	51.0	1			48.0	4	48.0	7	24——28
28——32							45.0	1									51.0	1	48.0	2	28——32
32——36					54.0	2			62.0	1	40.0	1			41.3	3	54.0	1	50.3	8	32——36
36——40					45.0	1					45.0	1	44.5	2	41.0	2	46.0	1	44.3	7	36——40
40——44					52.5	2													52.5	2	40——44
TOT. TRUCKS	9		32		63		39		20		33		70		53		58		377		TOT. TRUCKS
AVG. WT. (LBS)	12,000		11,600		13,600		13,800		12,700		13,500		12,600		12,200		14,600		13,000		AVG. WT. (LBS)
AVG. SPEED	46.0		53.1		46.1		49.5		51.4		47.9		49.8		44.2		49.5		48.6		AVG. SPEED

R HOUR

WEIGHT	OF MIS	STATION 81 AUG. 26, 1960 AVG. SPEED	NO. OF SEMIS	SUMMARY AVG. SPEED	NO. OF SEMIS	WEIGHT (KIPS)
0 —				61.0	1	0 — 8
8 —				54.5	5	8 — 12
12 —				54.0	5	12 — 16
16 —		52.0	2	51.2	31	16 — 20
20 —		51.5	2	51.1	64	20 — 24
24 —		55.5	4	52.0	109	24 — 28
28 —		52.7	4	52.3	84	28 — 32
32 —		50.7	4	50.5	34	32 — 36
36 —		47.0	1	50.9	30	36 — 40
40 —				50.3	34	40 — 44
44 —		56.5	2	50.6	32	44 — 48
48 —				50.3	31	48 — 52
52 —		50.0	1	49.3	48	52 — 56
56 —		46.0	1	48.8	47	56 — 60
60 —		54.0	1	49.2	24	60 — 64
64 —				48.3	13	64 — 68
68 —				51.4	15	68 — 72
72 —		50.0	1	50.7	16	72 — 76
76 —				48.2	15	76 — 80
80 —		55.0	1	52.5	4	80 — 84
84 —				53.5	3	84 — 88
TOT. T		24		644		TOT. TRUCKS
AVG. WT		37,400		39,300		AVG. WT.(LBS)
AVG. SPE		51.7		50.3		AVG. SPEED (MPH)

TABLE II SEMI-TRAILERS (MULTIPLE UNITS) SPEEDS IN MILES PER HOUR

WEIGHT (KIPS)	STATION 458 AUG. 4, 1960		STATION 5 AUG. 10, 1960		STATION 4 AUG. 11, 1960		STATION 2 AUG. 12, 1960		STATION 14 AUG. 17, 1960		STATION 42 AUG. 22, 1960		STATION 588 AUG. 23, 1960		STATION 75 AUG. 24, 1960		STATION 81 AUG. 26, 1960		SUMMARY		WEIGHT (KIPS)
	AVG. SPEED	NO. OF SEMIS	AVG. SPEED	NO. OF SEMIS	AVG. SPEED	NO. OF SEMIS	AVG. SPEED	NO. OF SEMIS	AVG. SPEED	NO. OF SEMIS	AVG. SPEED	NO. OF SEMIS	AVG. SPEED	NO. OF SEMIS	AVG. SPEED	NO. OF SEMIS	AVG. SPEED	NO. OF SEMIS	AVG. SPEED	NO. OF SEMIS	
0 — 8					61.0	1													61.0	1	0 — 8
8 — 12			60.0	2			48.0	1					55.5	2					54.5	5	8 — 12
12 — 16	48.0	1	62.0	1	54.0	2			52.0	1									54.0	5	12 — 16
16 — 20			57.0	2	53.0	5	50.3	3	50.4	8	47.0	5	49.0	2	50.7	4	52.0	2	51.2	31	16 — 20
20 — 24	43.5	4	51.7	9	54.2	4	51.8	11	52.4	7	50.7	7	55.5	13	48.9	7	51.5	2	51.1	64	20 — 24
24 — 28	46.2	9	53.4	11	53.4	5	54.8	10	55.4	18	45.6	23	52.5	15	51.3	14	55.5	4	52.0	109	24 — 28
28 — 32	48.5	4	49.5	12	54.7	7	52.7	6	56.4	12	49.4	11	55.5	12	51.3	7	52.7	4	52.3	84	28 — 32
32 — 36	43.5	2	47.0	3	54.0	8	53.2	4	54.0	2	50.0	8	51.7	3			50.7	4	50.5	34	32 — 36
36 — 40	46.0	1	51.6	5	52.0	3	52.8	6	55.3	3	49.7	3	53.3	6	50.0	2	47.0	1	50.9	30	36 — 40
40 — 44	34.0	1	48.5	2	49.7	4	53.2	5	57.2	5	47.7	11	55.4	5	57.0	1			50.3	34	40 — 44
44 — 48	47.3	3	54.0	6	46.0	1	49.6	5	52.6	5	42.0	4	55.0	2	52.2	4	56.5	2	50.6	32	44 — 48
48 — 52			53.0	6	54.3	3	54.0	7	53.6	7	44.7	4	47.5	2	45.0	2			50.3	31	48 — 52
52 — 56	45.0	2	47.9	9	52.5	2	50.4	7	55.0	11	46.2	6	44.8	6	51.0	4	50.0	1	49.3	48	52 — 56
56 — 60	44.0	1	51.3	10	54.0	1	50.0	5	57.3	9	44.3	6	47.7	6	44.5	8	46.0	1	48.8	47	56 — 60
60 — 64			50.6	5	46.0	1	50.0	2	51.2	5	40.7	3	46.8	5	54.5	2	54.0	1	49.2	24	60 — 64
64 — 68	46.0	1	49.7	3			52.0	1	51.0	5			49.0	1	42.0	2			48.3	13	64 — 68
68 — 72			53.7	4			51.3	3	53.2	4	44.5	2	56.0	1	43.0	1			51.4	15	68 — 72
72 — 76			56.0	1	52.5	2	47.0	3	55.3	3	47.7	3	46.3	3			50.0	1	50.7	16	72 — 76
76 — 80	42.0	1	50.0	1	48.0	1	47.0	3	60.0	1	46.0	2	45.5	2	47.0	4			48.2	15	76 — 80
80 — 84					54.5	2	48.0	1									55.0	1	52.5	4	80 — 84
84 — 88			53.0	2	54.0	1													53.5	3	84 — 88
TOT. TRUCKS	30		93		53		83		106		98		95		62		24		644		TOT. TRUCKS
AVG. WT. (LBS)	34,900		43,200		38,100		42,300		41,800		38,000		37,700		40,700		37,400		39,300		AVG. WT.(LBS)
AVG. SPEED (MPH)	44.5		52.6		52.7		50.9		54.2		46.4		51.0		49.2		51.7		50.3		AVG. SPEED (MPH)

TABLE III
VEHICLES EXCEEDING SPEED LIMIT

	TRUCKS WEIGHING UNDER 5000 LBS.			TRUCKS WEIGHING OVER 5000 LBS			MULTIPLE UNITS		
Station	No. Noted	% Exceeding 65 MPH*	% Exceeding 70 MPH**	No. Noted	% Exceeding 50 MPH*	% Exceeding 55 MPH**	No. Noted	% Exceeding 50 MPH*	% Exceeding 55 MPH**
45B	5	0.0	0.0	9	11.1	11.1	30	10.0	0.0
4	8	12.5	12.5	63	63.5	36.5	53	62.3	32.1
5	2	0.0	0.0	32	65.7	43.8	93	36.5	16.1
81	17	5.9	0.0	58	34.5	15.5	24	58.3	33.3
					% Exceeding 55 MPH*	% Exceeding 60 MPH**		% Exceeding 55 MPH*	% Exceeding 60 MPH**
2	3	0.0	0.0	39	23.1	2.6	83	16.9	0.0
14	3	33.3	33.3	20	25.0	15.0	106	42.4	2.8
42	0	0.0	0.0	33	21.2	9.1	98	10.2	1.0
58B	0	0.0	0.0	70	35.7	7.1	95	32.7	3.2
75	9	11.1	0.0	53	13.2	9.4	62	20.9	4.8
Summary	47	8.5	4.3	377	35.8	17.0	644	30.6	7.8

* Legal Speed Limit for the Various Classes of Highways and Vehicles

** The Enforcement Speed is Considered to be the Legal Speed Limit Plus 5 M.P.H.

TABLE IV

TRUCK WEIGHT-SPEED DATA
COMPARISON OF DATA FROM STUDIES IN VARIOUS YEARS

	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960
No. of Single-Unit Trucks	578	791	1242	1482	1239	905	762	952	1028	837	481	424
Ave. Speed of Single-Unit Trucks	42.2	42.4	43.0	43.4	43.9	45.8	45.9	47.0	46.3	46.5	45.5	49.1
Ave. Weight of Single-Unit Trucks	9,400	8,700	8,600	8,700	8,400	8,000	8,900	8,300	9,400	9,900	9,230	12,000
No. of Multiple-Unit Trucks	581	879	1,402	1,354	1,507	1,064	1,120	1,033	1,161	1,130	604	644
Ave. Speed of Multiple-Unit Trucks	43.2	42.7	43.5	44.1	43.1	43.6	43.5	44.4	42.5	46.1	48.6	50.3
Ave. Weight of Multiple-Unit Trucks	32,500	36,700	36,700	35,900	35,800	37,400	38,400	37,900	37,100	39,500	40,300	39,300

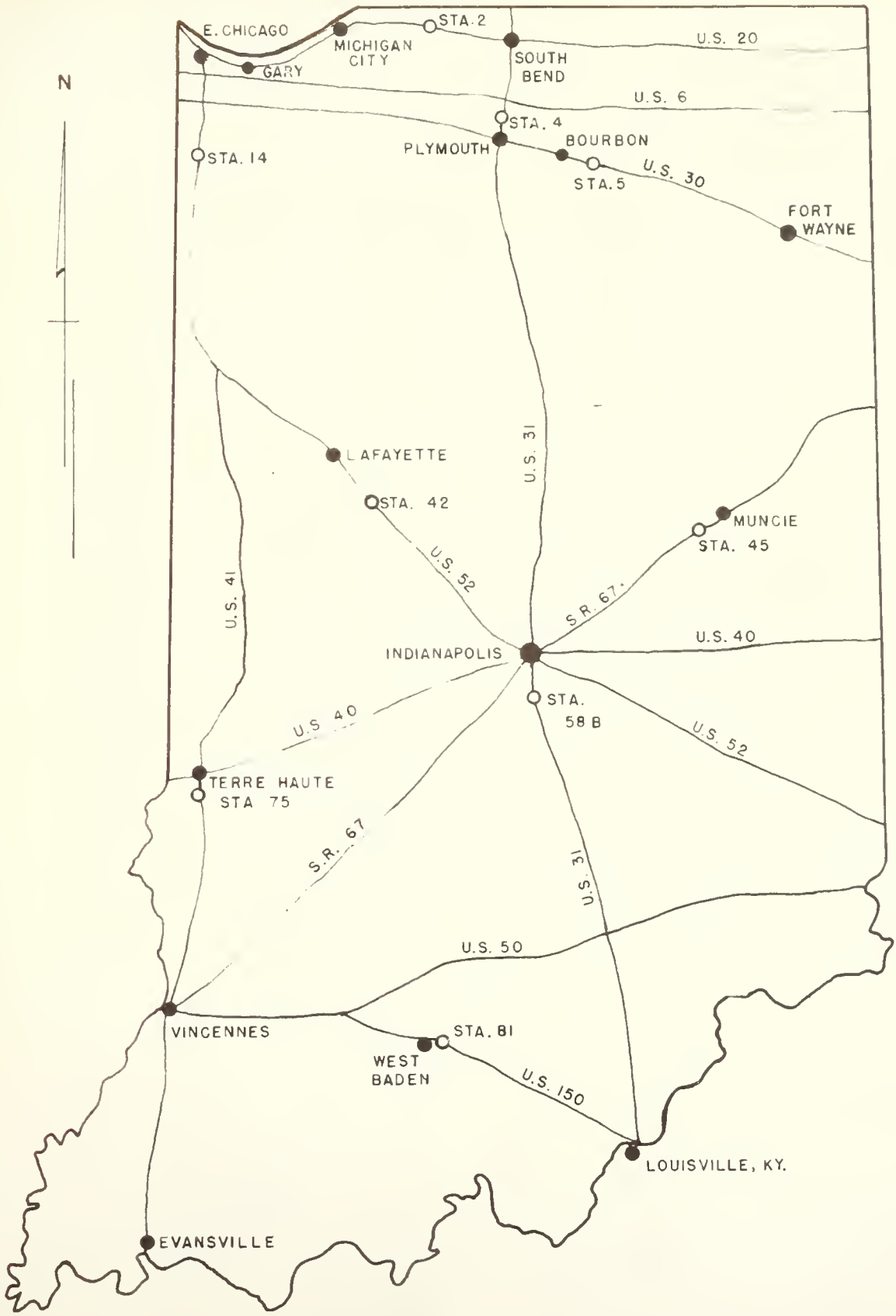
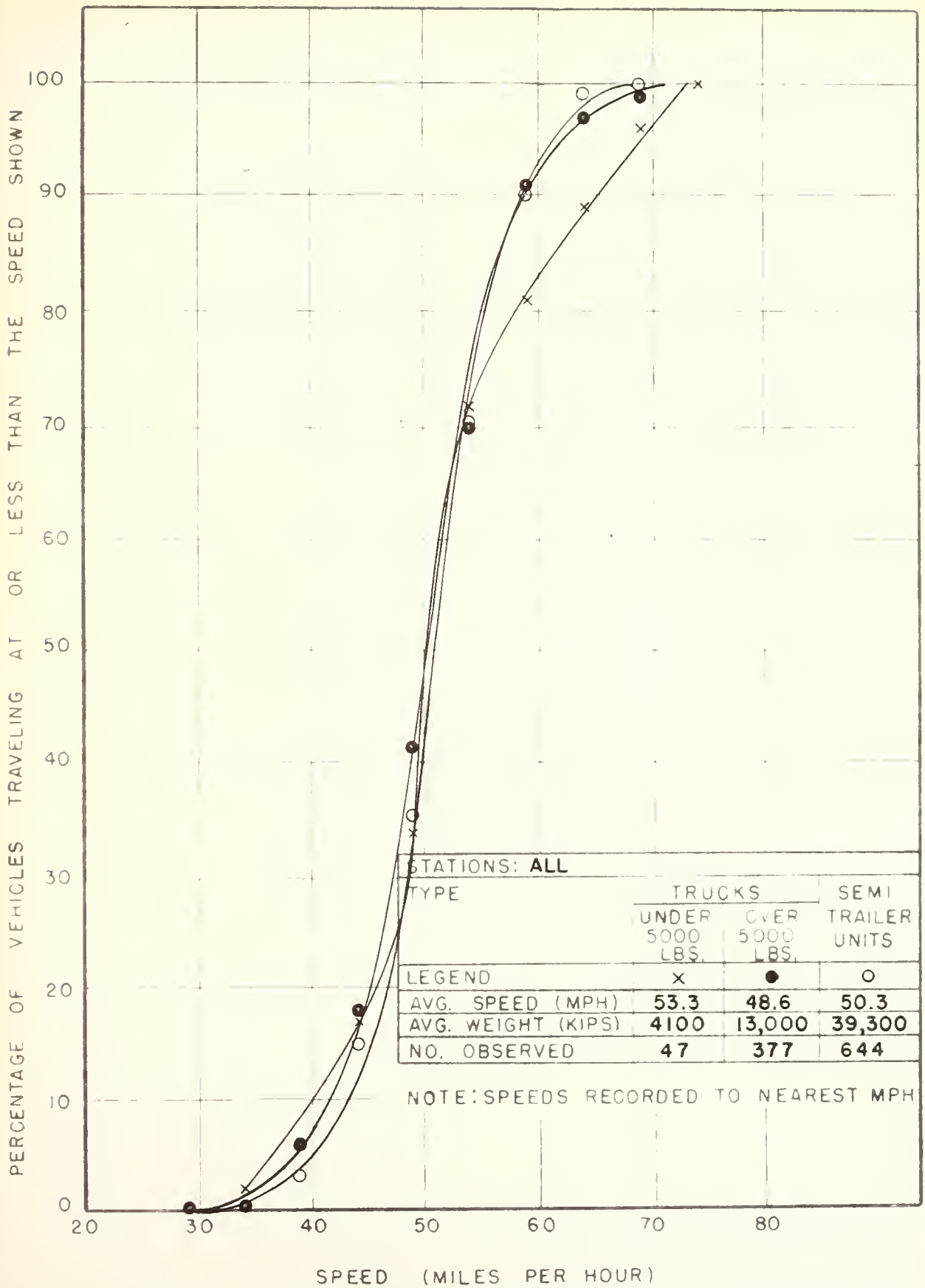
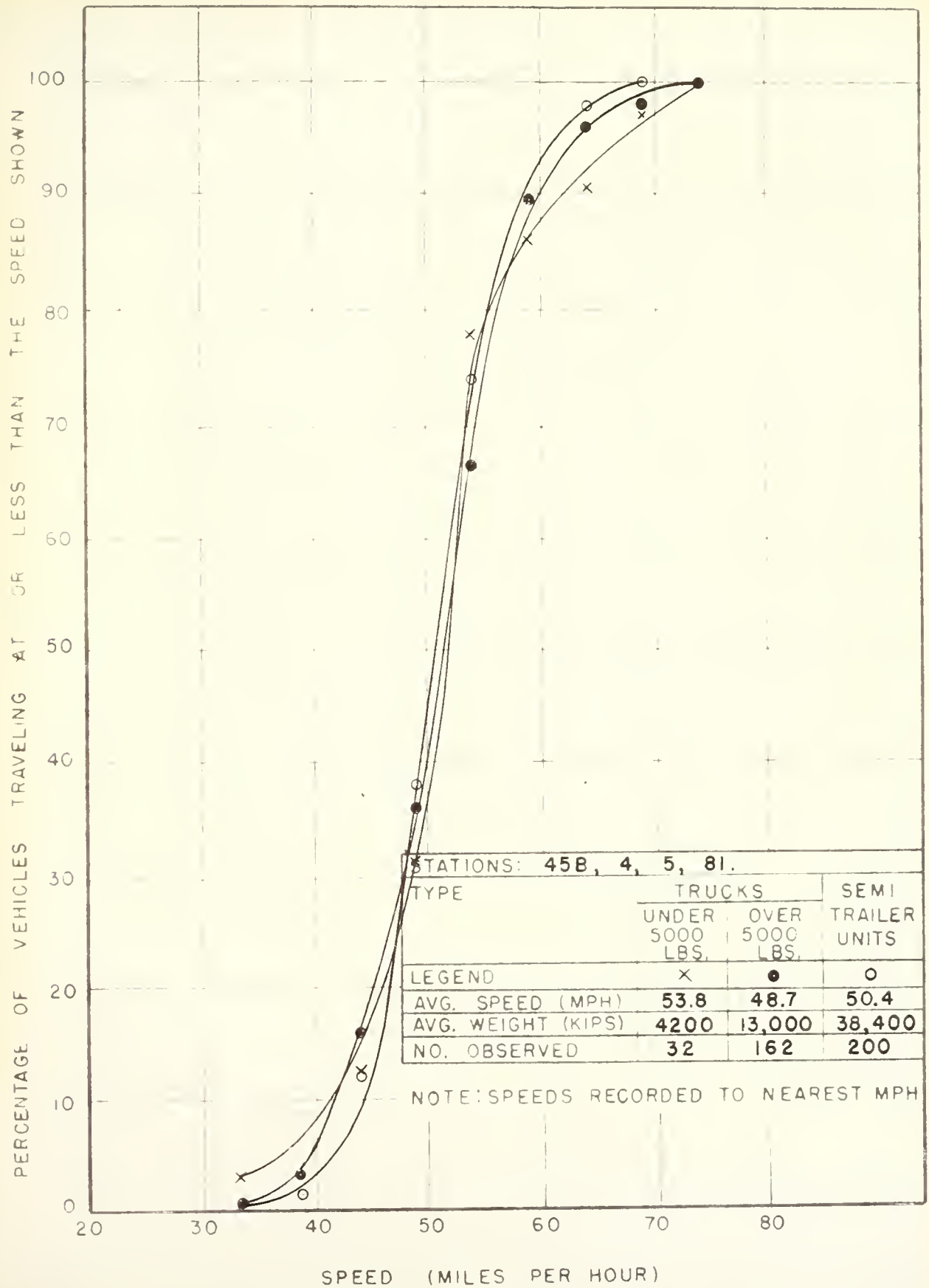


FIG. 1 LOCATIONS OF TRUCK WEIGHT - SPEED STATIONS



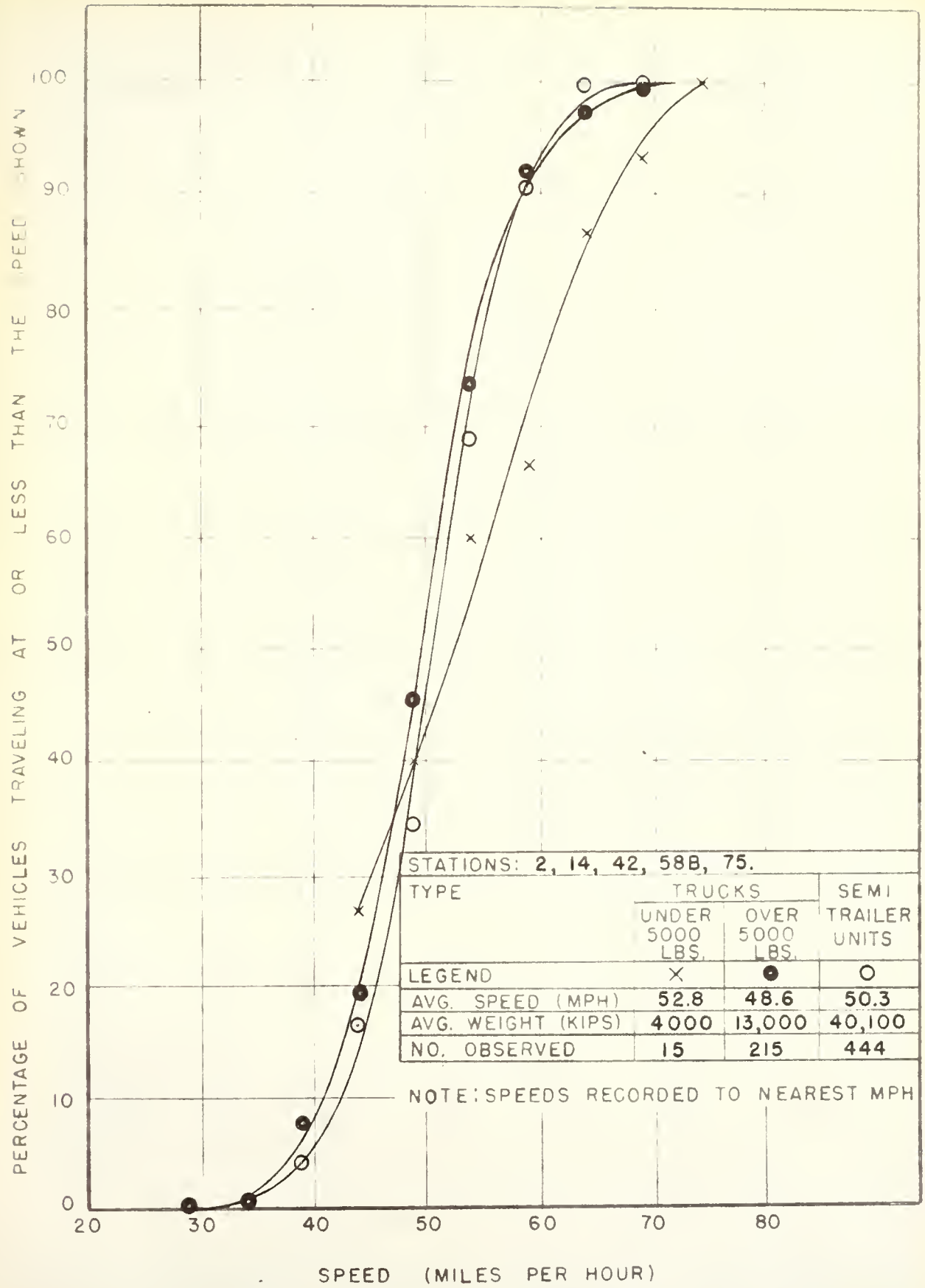
SPEED ACCUMULATION CURVES FOR ALL HIGHWAYS

FIG. 2



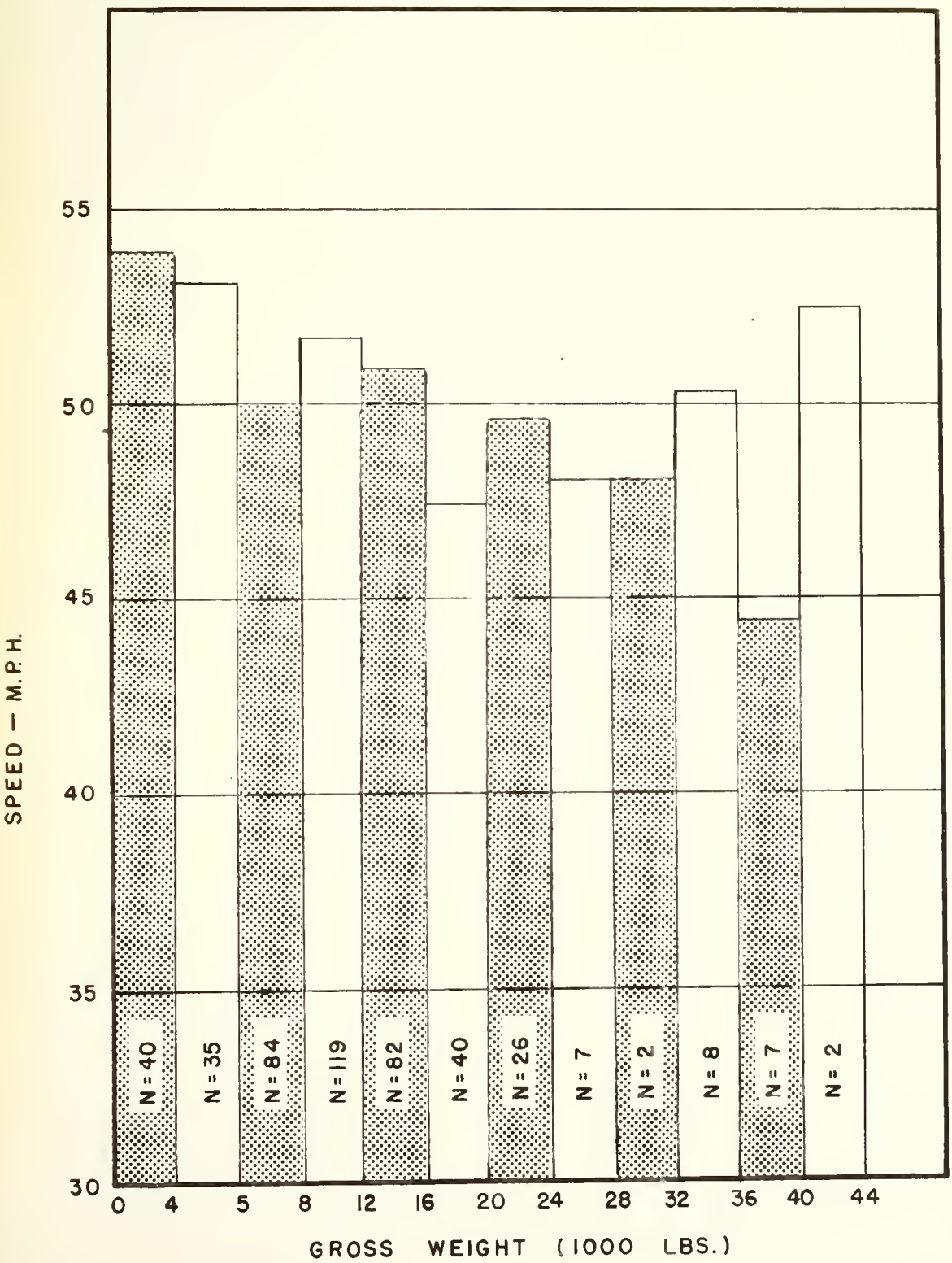
SPEED ACCUMULATION CURVES FOR 2-LANE HIGHWAYS

FIG. 3



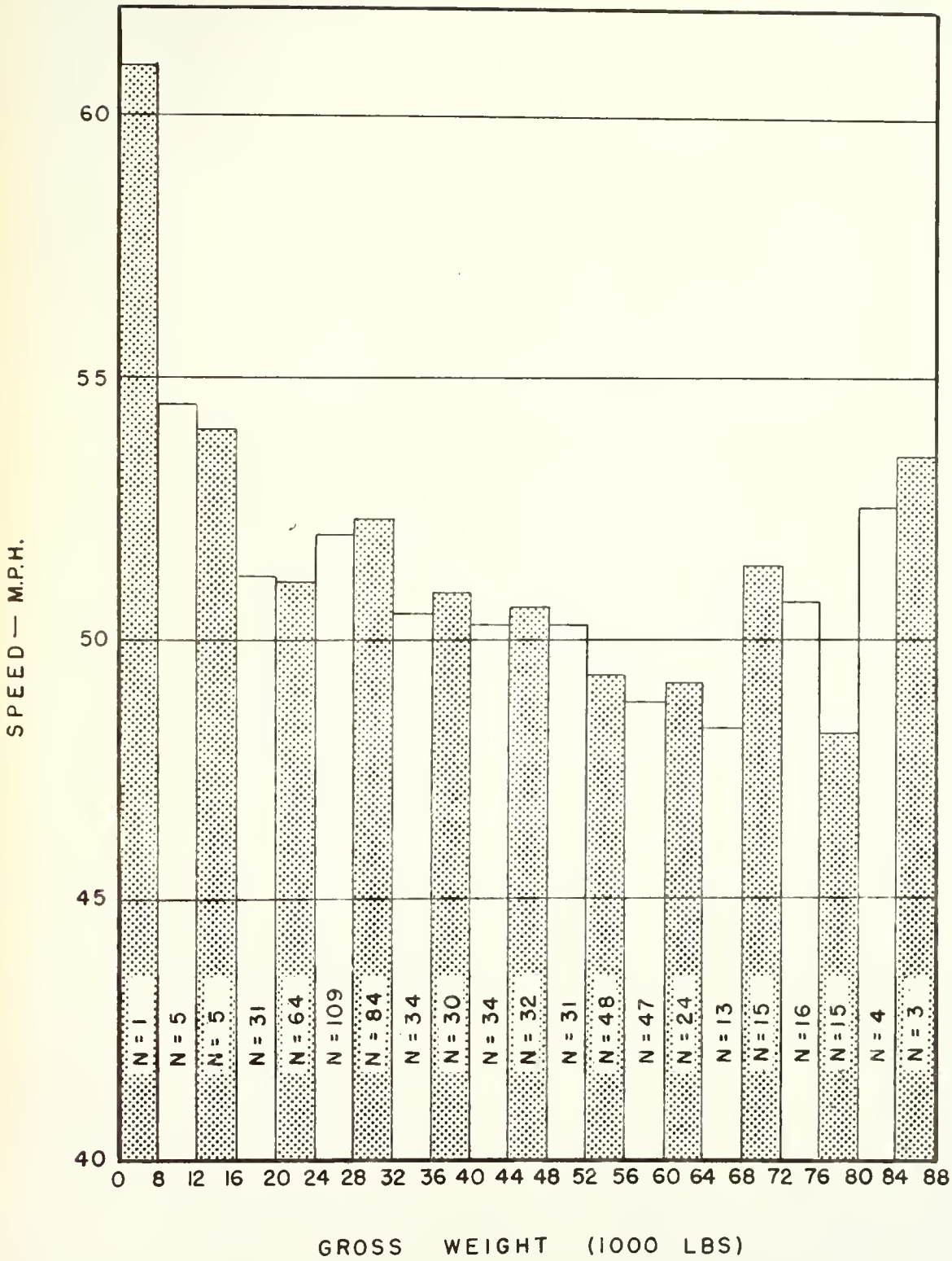
SPEED ACCUMULATION CURVES FOR 4-LANE HIGHWAYS

FIG. 4



AVERAGE SPEED VS. GROSS WEIGHT FOR SINGLE UNITS

FIG. 5



AVERAGE SPEED VS. GROSS WEIGHT FOR MULTIPLE UNITS

FIG. 6